



How effectively does CBT-I address the traumatic and functional causes of insomnia and sleep disturbance in Veterans?

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ABSTRACT

Introduction: An interaction between functional and traumatic predisposing, precipitating, and perpetuating factors is suggested to explain the comparatively high prevalence of insomnia in the Veteran population. Cognitive-behavioural therapy for insomnia (CBT-I) has been recommended as a first-line treatment for insomnia in the Veteran community; however, little is known about the effectiveness of CBT-I for Veterans. This article reviews the findings and quality of nine randomized controlled trials (RCTs) of the effectiveness of CBT-I in the Veteran population with two objectives: 1) to assess whether the evidence exhibits the effectiveness of individual components of CBT-I and 2) to evaluate whether CBT-I is effective in addressing functional and traumatic causes of insomnia in this population. **Methods:** A search for suitable articles was conducted using a number of key terms, including Veterans, CBT-I, and insomnia, and then by applying inclusion and exclusion criteria. The findings and quality of nine RCTs were reviewed by two raters using the Critical Research Evaluation Schedule for Trainees, and inter-rater reliability was obtained. **Results:** The effectiveness of CBT-I across all measures of insomnia was inconsistent. Studies generally relied on unvalidated outcome measures and lacked adequate sample sizes and control of extraneous variables. **Discussion:** The findings presented did not support a stepped model of CBT-I for the treatment of insomnia among Veterans, which suggests the importance of reviewing current guidance for the treatment of Veterans with insomnia.

Key words: CBT, CBT-I, cognitive-behavioural therapy, insomnia, military psychiatry, sleep, sleep initiation and maintenance disorders, Veterans

RÉSUMÉ

Introduction : Une interaction entre des facteurs fonctionnels et traumatiques prédisposants, déclencheurs et persistants est invoquée pour expliquer la prévalence comparativement élevée d'insomnie dans la population de vétéran(e)s. La thérapie cognitivo-comportementale contre l'insomnie (TCC-i) est recommandée comme traitement de première ligne contre l'insomnie dans la communauté de vétéran(e)s, mais on sait peu de choses sur l'efficacité de la TCC-i chez les vétéran(e)s. Cet article analyse les observations et la qualité de neuf essais cliniques randomisés (ECR) sur l'efficacité de la TCC-i dans la population de vétéran(e)s, et ce, pour deux objectifs : 1) évaluer si les données probantes démontrent l'efficacité des éléments individuels de la TCC-i et 2) évaluer si la TCC-i est efficace pour régler les causes fonctionnelles et traumatiques de l'insomnie au sein de cette population. **Méthodologie :** Les chercheurs ont fouillé les articles appropriés à l'aide d'un certain nombre de termes clés : *Veterans*, *CBT-I* et *insomnia*, puis leur ont appliqué des critères d'inclusion et d'exclusion. Deux évaluateurs ont examiné les observations et les neuf ECR au moyen du calendrier d'évaluation de recherches essentielles et ont obtenu la fiabilité interévaluateur. **Résultats :** L'efficacité de la TCC-i n'était pas cohérente dans toutes les mesures d'insomnie. En général, les études reposaient sur des mesures d'issue non validées et ne disposaient pas d'une taille d'échantillon et d'un contrôle des variables extérieures suffisants. **Discussion :** Les observations présentées n'appuient pas un modèle graduel de TCC-i pour le traitement de l'insomnie chez les vétéran(e)s, ce qui laisse supposer l'importance d'examiner les directives actuelles sur le traitement des vétéran(e)s insomniaque.

Mots-clés : initiation du sommeil et troubles de maintenance, insomnie, TCC, TCC-i, thérapie cognitivo-comportementale, psychiatrie chez les militaires, sommeil, vétéran(e)s

LAY SUMMARY

Cognitive-behavioural therapy for insomnia (CBT-I) continues to be recommended as the first-line treatment for an increasing number of Veterans seeking help for insomnia. Unfortunately, these recommendations are made on the basis

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of evidence from the general public, who do not experience the same predisposing, activating, and maintaining causes of insomnia as Veterans. This review considers whether CBT-I really addresses the causes of insomnia among Veterans, which can be labelled as functional (e.g., caffeine use) and traumatic (e.g., nightmares). Nine randomized controlled trials of CBT-I delivered to Veterans having trouble falling or staying asleep were reviewed. Evidence was not consistent enough to support the continued recommendation of CBT-I as a first-line treatment for insomnia among Veterans. On a wider level, the authors question whether psychological causes of a mental health problem are always, or should be, fully considered in the process of creating clinical guidelines for treatment.

INTRODUCTION

Insomnia is defined as a dissatisfaction with sleep quality or quantity as a result of difficulty falling or staying asleep, with daytime implications such as poor concentration and obsessive concern.^{1,2} A combination of semi-structured interviews, screening measures, and sleep diaries is recommended for the formal assessment of insomnia.^{3,4} Throughout the process of assessment, other sleep disorders, such as sleep apnoea, circadian rhythm disorders, restless legs syndrome, narcolepsy, and parasomnias, and medical and psychological causes should be considered and addressed accordingly.^{1,2,3,4}

Insomnia is estimated to affect at least one-third of British and Canadian populations.^{5,6} Moreover, chronic sleep difficulties are particularly prevalent among Canadian treatment-seeking Veterans.⁷ The percentage of the entire U.S. military population who met the criteria for insomnia increased by 652% over the course of recent operations in Iraq and Afghanistan.⁸ Moreover, 90% of a recent sample of U.S. servicemen and Veterans were identified as poor sleepers.⁹ Although insomnia-specific data do not appear to exist for British Veteran populations,¹⁰ specialist services reported a fourfold increase in referrals for all mental health presentations from 1994 to 2014.¹¹ Insomnia and difficulty sleeping are widely reported, along with a range of mental health problems in both military and general populations.^{12,13} Disturbed sleep has been linked to an increased risk of mortality, irrespective of cause.¹⁴ Within the Veteran population, the impact of insomnia on daytime cognitive, emotional, and behavioural functioning is understood to increase suicidal ideation and behaviour.^{15,16}

To conceptualize the clinical presentation among Veterans, Bramoweth and Germain consolidated evidence to adapt a stress-diathesis model of insomnia to identify the predisposing, precipitating, and perpetuating causes of insomnia common in the military population:¹⁷

Predisposing factors: A combination of cultural and environmental factors, such as disproportionately

higher rates of adverse childhood experiences, predispose military cadets to the onset of insomnia.¹⁸ Early traumatic experiences and the development of anxious attachment styles were found to impair rapid eye movement sleep and increase neural activity during Stage 3 and 4 sleep among Veterans.^{19,20} Moreover, military cadets were reported to endure continuous sleep deprivation as a consequence of cultural expectations and training demands and are thus predisposed to a later onset of insomnia.²¹

Precipitating factors: The key precipitants of the onset of insomnia among Veterans reportedly occur during deployment.^{17,22} Regardless of experiences, deployment itself increases the risk of the onset of insomnia by two-fold and more if it lasts longer than 10 months.⁸ Sleep deprivation has been widely reported during deployment and is understood to be the result of poorly implemented strategies to address disruptive environments,^{23–25} dysfunctional sleep patterns, and compensatory behaviours.²⁶ The experience of traumatic events during deployment, including threat to life, reportedly results in hyper-arousal, hyper-vigilance, and nightmares that precipitate difficulty falling or staying asleep.²⁷

Perpetuating factors: Two types of perpetuating factors are understood to maintain insomnia and poor sleep among Veterans. First, functional factors, such as continued dysfunctional beliefs and behaviours associated with sleep,^{28–31} are understood to unintentionally maintain the problem.¹⁷ Second, traumatic factors, such as hyper-vigilance and diagnosed or sub-threshold symptoms of posttraumatic stress disorder (PTSD; e.g., hyper-arousal and nightmares) perpetuate difficulty falling and staying asleep.²⁹ Moreover, insomnia has been argued to mediate the relationship between PTSD treatment and outcome among Veterans.³² Thus, insomnia presents as being uniquely perpetuated within the Veteran population by means of a particular combination of functional and traumatic factors.¹⁷

Cognitive-behavioural therapy for insomnia (CBT-I) consists of psycho-education about sleep hygiene, cog-

nitive restructuring of relevant dysfunctional beliefs, and behavioural interventions.³³ The behavioural interventions usually involve sleep restriction techniques in which a patient reduces the time spent in bed to match the time spent asleep.³³ It may also involve stimulus control therapies, such as reducing activities conducted in the bedroom, other than sleep or sex, to reduce unhelpful associations with bedtime.³³ CBT-I was successfully adapted to condense delivery of the same intervention across fewer sessions than the recommended eight and by omitting cognitive therapy in brief behavioural interventions.³³⁻³⁵

CBT-I is widely favoured as a first-line treatment for insomnia in the general population because of its effectiveness and the lack of side effects associated with pharmacological treatment.^{3,36,37} In the United States, these clinical recommendations were extended to the Veteran population on the basis of evidence obtained in a pilot training program.^{38,39} In the United Kingdom, no Veteran-specific recommendations exist for insomnia treatment; thus, it is assumed that Veterans are treated in line with national guidelines.³ The same is understood to be true in Canada, although no national guidelines exist for the treatment of insomnia in the general population,⁴⁰ and thus Veterans are treated in line with regional guidelines.⁴

Given the increasing level of presentations, treatment guidelines should be supported by an evidence base that reflects the unique factors that contribute to the development and maintenance of insomnia among Veterans. To date, the only review of the effectiveness of CBT-I in the Veteran population is part of a wider Rapid Evidence Assessment (REA) of various psychological treatments for insomnia.⁴¹ The REA reviewed 10 trials, only one of which was a randomized controlled trial (RCT). Phelps and colleagues concluded that, although the quality of evidence was weak, CBT-I was a promising intervention,⁴¹ and they endorsed the use of CBT-I in conjunction with other psychotherapies targeting PTSD nightmares, such as imagery rehearsal therapy (IRT), which aims to rescript recurring nightmares to decrease the correlated distress.⁴² The REA provided little discussion of the shortcomings of CBT-I in addressing Veteran needs and recommended a more detailed evaluation of the effectiveness of the intervention and its individual components.

This narrative review builds on the recommendations of Phelps and colleagues to conduct a thorough

evaluation of the best-controlled trials of the effectiveness of CBT-I with the Veteran population.⁴¹ The first objective was to evaluate whether the evidence base demonstrates the effectiveness of individual components of CBT-I in treating insomnia among Veterans. The second objective was to review whether the studies considered and evaluated the effectiveness of CBT-I in addressing the maintaining causes — both functional and traumatic — of insomnia among Veterans. The rationale for the second objective was that the effectiveness of psychological treatment, particularly CBT, is measured by its ability to resolve the perpetuating factors of a disorder.

METHODS

A series of Boolean searches across eight databases (Cumulative Index to Nursing and Allied Health Literature [CINAHL], MEDLINE, PsycINFO, Web of Science, Cochrane Database, Google Scholar, Scopus, ProQuest Public Health) were conducted for terms relating to CBT, Veteran, and insomnia. Inclusion and exclusion criteria (Table 1) were applied, and nine articles (of 175) met the objectives of the review (Table 2).⁴³⁻⁵¹ No limitations were applied to refine the search by year or language of publication. Non-English texts were only disregarded if no translation was available.

The Critical Research Evaluation Schedule for Trainees (CREST) was used to conduct a qualitative evaluation of the nine trials (“Guidelines for completing the ‘Clinical Research Evaluation Sheet for Trainees’ (CREST),” unpublished manuscript by Peck, Dow, and Goodall).⁴³⁻⁵¹ The CREST consists of a reliability and validity scale and 40 sub-scales covering the statistical, design, informative, and discursive quality of the evidence. Although the non-validated tool generates a score for each study, it is not used to categorize the quality of the data but instead acts as a framework for a discursive, qualitative evaluation of the evidence reviewed. The advantage of using this tool is that it provides a structured process by which thorough evaluation of the studies can be undertaken and the quality of the reported outcome data can be discussed and debated. The qualitative evaluation was conducted by two raters (JR and FW). To consider the objectiveness of this approach, the inter-rater reliability was calculated using intra-class correlation coefficients (ICCs) for evaluations of reliability and validity, respectively, and all other sub-headings collectively.

Table 1. Inclusion and exclusion criteria

Aspect	Inclusion	Exclusion
Participants	<ul style="list-style-type: none"> • Aged older than 18 y • Discharged from military service • Met criteria for insomnia diagnosis (DSM-5 or ICD-10) 	<ul style="list-style-type: none"> • Actively serving in military • Diagnosis of or reported traumatic brain injury, chronic pain, or substance use disorder • Exclusively older adult population
Intervention	<ul style="list-style-type: none"> • CBT-I delivered face to face • Condensed form of CBT-I if components explicitly stated • Control group treatment as usual, low-intensity emotional support, placebo, waitlist, or psychoeducation 	<ul style="list-style-type: none"> • Delivered in group, remote, or digital format
Outcome measures	<ul style="list-style-type: none"> • Valid subjective or objective measurement of insomnia symptoms 	
Study design or article status	<ul style="list-style-type: none"> • Randomised controlled trial • Peer reviewed and published 	<ul style="list-style-type: none"> • Non-controlled trial • Non-inferiority trial • Dissertation

DSM-5 = Diagnostic and Statistical Manual of Mental Disorders (5th ed.); ICD-10 = ICD-10 Classification of Mental and Behavioural Disorders; CBT-I = cognitive-behavioural therapy for insomnia.

RESULTS

Each RCT reviewed assessed the impact of CBT-I on symptoms of insomnia among Veterans. All study participants were recruited from primary care and non-clinical samples and were representative of the U.S. Veteran population (e.g., mean age 66 y, 91% male, 77% Caucasian).⁵² All nine RCTs reviewed (Table 2) demonstrated an effect of CBT-I on reducing symptoms on at least one measure of insomnia.⁴³⁻⁵¹ Only two studies demonstrated a consistent effect of CBT-I across multiple measures of insomnia.^{44,45} Three studies were considered to demonstrate an overall good effect of CBT-I on symptoms of insomnia but varied comparatively on clinically significant improvements and effects on specific sleep diary items and dysfunctional beliefs about sleep.^{43,47,48} One trial reported no change on the validated measure used but an effect on specific sleep diary items, which was generally not maintained at follow-up.⁴⁹ Two studies found an effect on only one self-report measure out of several subjective and objective measures of insomnia.^{46,51} Thus, all studies demonstrated some effect of CBT-I on the severity of insomnia symptoms, but to varying degrees.

Most studies did theoretically consider the impact of trauma on insomnia and measured the effect of treatment on perpetuating factors such as nightmares and hyper-arousal.^{45-48,50,51} The degree to which treatment conditions were explicitly adapted to address trauma varied across all trials reviewed. Two studies made no explicit alteration,^{46,50} and one discussed military-specific factors in psychoeducation.⁴⁸ None of

the three found any significant effect on symptoms of trauma. In addition to CBT-I, two studies incorporated IRT.^{45,47} Although neither study evaluated the effectiveness of individual components, both studies reported an improvement in all symptoms of PTSD, and one reported a reduction in nightmares.⁴⁷ Another study provided the most comprehensive evaluation of traumatic symptoms after tailored adjustments to CBT-I.⁵¹ Both the control and test groups engaged in prolonged exposure, which is a graded, structured approach to repeatedly experience memories and situations related to a traumatic incident.^{51,53} The aim was for the patient to learn that the stimuli are harmless, habituate to the associated distress, and process the past experiences to reduce the frequency of intrusive memories and related thoughts.^{51,53} The study found a substantial reduction in daytime and nighttime PTSD symptoms after prolonged exposure, but no further improvements after the addition of IRT or CBT-I.

The statistical, methodological, and discursive quality of the nine articles reviewed was inconsistent. The final CREST scores ranged from 54% to a near-perfect 97% (Table 3). Incidentally, the agreement between the two raters was also inconsistent, as indicated by poor inter-rater reliability calculations for reliability (ICC = 0.20, 95% CI = -0.41 to 0.72) and validity (ICC = 0.09, 95% CI = -0.39 to 0.64) and fair inter-rater reliability for all other subheadings (ICC = 0.53, 95% CI = 0.27-0.67). Possible reasons for the poor and fair inter-rater reliability are considered in the Limitations section of this article.

Table 2. Summary of studies

Study	Aim, Design, and Sample Size	Results*
Edinger & Sampson ⁴³	<p>Aim: To compare the effectiveness of ACBT compared with SHC in reducing symptoms of insomnia</p> <p>Design: Single-blind RCT comparing outcomes between conditions (2 25-min sessions of ACBT or SHC 2 wk apart) at baseline and post-treatment</p> <p>N = 20</p>	<ul style="list-style-type: none"> • Significant effect of ACBT on overall sleep log measure ($p = 0.0001$). Changes in SE was the only specific sleep log item found to significantly differ between the two conditions ($p = 0.008$). • Significant within-condition changes between time on SES ($p < 0.005$) and DBAS ($p < 0.0005$).[†]
Edinger et al. ⁴⁴	<p>Aim: Compare short- and long-term effects of CBT-I vs. SHC on reducing symptoms of insomnia</p> <p>Design: RCT to compare outcomes for PI and CI between conditions (30- to 60-min sessions of CBT-I or SHC) 4x biweekly at baseline, post-treatment, and 6-mo follow-up</p> <p>N = 81</p>	<ul style="list-style-type: none"> • CBT-I group demonstrated modest significantly greater post-treatment improvements than SH on sleep diary items: SOL ($p = 0.005$, $ES = -0.48$) and SE ($p = 0.005$, $ES = 0.46$); on ISQ outcome ($p = 0.03$, $ES = -0.53$); and on DBAS outcomes ($p = 0.03$, $ES = -0.95$). CBT-I also demonstrated significantly greater reductions in actigraphy measures of WASO ($p = 0.02$, $ES = -0.043$). • Only difference at follow-up was that the CBT-I group demonstrated modest significantly greater improvements than the SH group in ISQ outcome ($p = 0.03$, $ES = -0.58$). • Differences between PI and CI: clinically significant improvements in PSQI and WASO scores were prevalent in the CBT-I PI group (60% and 75%, respectively) but not in the CBT-I CI (36.7% and 19%, respectively) or control PI (25% and 27%, respectively) or CI (17.3% and 22%, respectively) groups. No significant interaction between insomnia type (primary or comorbid) and response to treatment.
Ulmer et al. ⁴⁵	<p>Aim: To compare effectiveness of CBT-I combined with IRT with TAU in reducing sleep disturbances among Veterans</p> <p>Design: RCT to compare outcomes between conditions (6 sessions: 3 treatment [CBT-I] + 3 IRT vs. control TAU [pharmacotherapy]) at baseline and post-treatment.</p> <p>N = 22</p>	<ul style="list-style-type: none"> • Treatment produced significantly greater baseline to post-intervention improvements than TAU in sleep diary measures of TST ($p = 0.02$, $d = 1.06$), WASO ($p = 0.02$, $d = -1.37$), SOL ($p = 0.004$, $d = -0.66$), and SE ($p = 0.001$, $d = 1.27$). • Treatment also produced significantly greater improvements in TAU nightmare frequency ($p = 0.04$, $d = -0.60$), ISI ($p = 0.003$, $d = -2.15$), PCL-M ($p < 0.001$, $d = -1.76$), and PSQI ($p < 0.001$, $d = -1.60$). No differences were seen on the PHQ-9 or PSQI-Addendum.
Germain et al. ⁴⁶	<p>Aim: To compare effectiveness of a BSI + prazosin (a blood-pressure-reducing medication) vs. placebo, then of BSI vs. prazosin in reducing symptoms of insomnia among Veterans</p> <p>Design: Two-arm RCT with follow-up comparing outcomes between conditions (8 weekly sessions of combined IRT + CBT-I vs. prazosin vs. placebo) between baseline and post-treatment</p> <p>N = 57</p>	<ul style="list-style-type: none"> • Compared with placebo, participants randomised to BSI or prazosin showed significantly greater improvements on the ISI ($p < 0.01$).[†] • Improvements on the ISI were significantly greater in the BSI than with prazosin ($p < 0.001$). • No significant effect of condition vs. time for PSQI, PSQI Addendum, sleep diary, or PSG.
Margolies et al. ⁴⁷	<p>Aim: To compare effectiveness of CBT-I + IRT with waitlist control in reducing insomnia symptoms among Veterans</p> <p>Design: RCT to compare outcomes between conditions (4 weekly sessions of CBT-I + IRT over 6-wk period vs. 6-wk waitlist control) from baseline to post-treatment</p> <p>N = 40</p>	<ul style="list-style-type: none"> • Significant, large effect of condition vs. time for overall sleep diary measures ($p = .002$, $\eta^2p = 0.43$) and individual sleep diary measures ($p < 0.001$, $\eta^2p = 0.40$), SOL ($p < .001$, $\eta^2p = 0.27$), and WASO ($p = 0.01$, $\eta^2p = 0.1$).[‡] • Significantly greater improvement for treatment compared with control in outcome for ISI ($p < .001$, $\eta^2p = 0.32$), PSQI ($p < 0.001$, $\eta^2p = 0.42$), PSQI-Addendum ($p = 0.01$), and PTSD symptom self-report ($p < 0.001$). • No significant interaction between conditions for DBAS.

Table 2. (Continued)

Study	Aim, Design, and Sample Size	Results*
Germain et al. ⁴⁸	<p>Aim: To compare effectiveness of BBTI-MV vs. IC in reducing insomnia severity and maintaining remission</p> <p>Design: RCT and uncontrolled follow-up to compare outcomes between conditions (4 weekly sessions of BBTI-MV vs. control [bibliotherapy]) at baseline and post-treatment and to compare post-treatment with 6-mo follow-up outcomes</p> <p>N = 40</p>	<ul style="list-style-type: none"> No effect of treatment condition on clinically significant improvements was found ($p > 0.05$). BBTI-MV showed a large significantly greater reduction in ISI than in IC ($p = 0.03$, $ES = 0.72$). BBTI-MV showed a large significantly greater reduction in PSQI than IC ($p = 0.02$, $ES = 0.76$). No significant effect of condition on PSQI-Addendum, PTSD Checklist, BDI, or BAI. No significant changes at 6-mo follow-up for BBTI-MV (participants remained in remission). No data available for follow-up comparison with IC because IC participants subsequently completed BBTI-MV.
Pigeon et al. ⁴⁹	<p>Aim: To compare effectiveness of CBT-I vs. SH in reducing SI and symptoms of depression and insomnia</p> <p>Design: RCT to compare outcomes between condition (4 weekly sessions of CBT-I vs. 1 session of psychoeducation + goal setting) at baseline, post-treatment, and 3-mo follow-up</p> <p>N = 27</p>	<ul style="list-style-type: none"> Compared with SH, the CBT-I group demonstrated significantly greater reduction in sleep diary WASO ($p = 0.046$, $g = -1.09$), number of awakenings ($p = .039$, $g = -0.75$), and SE ($p = 0.042$, $g = 0.90$) from baseline to post-treatment. No significant difference was found between groups on SOL, TST, PHQ-9, or ISI. Differences were non-significant at follow-up, except for number of awakenings ($p = 0.028$, $g = -0.89$).
Pigeon et al. ⁵⁰	<p>Aim: To compare effectiveness of bCBT-I vs. TAU in reducing SI</p> <p>Design: RCT to compare outcomes between conditions (4 sessions of CBT-I vs. TAU [treatment for comorbid presentation]) at baseline and post-treatment</p> <p>N = 54</p>	<ul style="list-style-type: none"> Small effect of bCBT-I on SI ($g = -0.26$). Large effect of bCBT-I on ISI ($g = -1.91$) and PHQ-9 ($g = -1.91$). Small effect of CBT-I on PTSD SC ($g = -0.17$). bCBT-I demonstrated significantly greater reduction in ISI than control ($p < 0.001$). ISI was not found to significantly mediate the relationship between condition and SI.
Walters et al. ⁵¹	<p>Aim: To compare effectiveness of prolonged exposure + IRT and CBT-I vs. prolonged exposure + SCT on reducing nightmare frequency and improving sleep efficiency among Veterans</p> <p>Design: RCT to compare scores at baseline, post-PE (12 weekly sessions), post-IRT (5 weekly sessions), and post-CBT (5 weekly sessions) treatment and equivalent control (12 weekly sessions of SCT)</p> <p>N = 23</p>	<ul style="list-style-type: none"> Before treatment comparison, PE resulted in significant improvements in PTSD symptoms: CAPS total score ($p < 0.001$, $ES = 0.70$), CAPS avoidance/numbing ($p < 0.001$, $ES = 0.82$), CAPS hyperarousal ($p = 0.001$, $ES = 0.65$), PSQI-Addendum nightmare frequency ($p = 0.006$, $d = 0.60$), and PCL ($p < 0.001$, $ES = 1.02$). No further effect of treatment condition (SCT, IRT, or CBT-I) on nightmare frequency (PSQI Addendum), CAPS score, PCL score, ISI score, actigraphy scores or sleep diary items (except SE). CBT-I significantly increased SE compared with SCT ($p = 0.04$, $d = 1.25$).

* Unless otherwise stated, effect sizes used 95% confidence intervals.

† Exact p-value not provided.

‡ For η^2p , 0.01 = small ES, 0.09 = moderate ES, 0.25 = large ES.

ACBT = abbreviated cognitive-behavioural therapy; SHC = sleep hygiene suggestions; RCT = randomised controlled trial; SE = sleep efficiency; SES = Self-Efficacy Scale; DBAS = Dysfunctional Beliefs About Sleep Scale; CBT-I = cognitive-behavioural therapy for insomnia; PI = primary insomnia; CI = comorbid insomnia; SH = sleep hygiene; SOL = sleep onset latency; ES = effect size; WASO = wake after sleep onset; ISQ = Insomnia Symptom Questionnaire; PSQI = Pittsburgh Sleep Quality Index; IRT = imagery rehearsal therapy; TAU = treatment as usual; TST = total sleep time; ISI = Insomnia Severity Index; PCL-M = PTSD Symptom Checklist-Military; PCL = PTSD Symptom Checklist; PHQ-9 = Patient Health Questionnaire (9 item); BSI = behavioural sleep intervention; PSG = polysomnography; PTSD = posttraumatic stress disorder; BBTI-MV = Brief Behavioural Treatment for Insomnia-Military Version; IC = information-only control; BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory; SI = suicidal ideation; bCBT-I = brief CBT-I???; PTSD SC = MV PTSD Symptom Checklist-Military Version; SCT = supportive care therapy; PE = prolonged exposure; CAPS = Clinician Administered PTSD Scale.

Table 3. CREST evaluations by section

Section	Edinger & Sampson ⁴³		Edinger et al. ⁴⁴		Ulmer et al. ⁴⁵		Germain et al. ⁴⁶		Margolies et al. ⁴⁷		Germain et al. ⁴⁸		Pigeon et al. ⁴⁹		Pigeon et al. ⁵⁰		Walters et al. ⁵¹		
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	
Rater																			
Reliability	6	7	6	9	6	10	7	8	7	7	8	10	6	9	6	10	6	6	6
Validity	3	7	6	9	7	9	8	8	7	8	10	10	6	9	6	10	8	7	7
Statistics	4	7	9	12	8	9	8	7	4	8	12	12	5	9	9	12	6	10	10
Figures, tables, graphs	6	8	7	8	7	8	7	7	6	8	8	8	7	8	7	8	8	6	6
Group equivalence	5	5	6	8	7	7	5	7	3	7	8	8	6	7	8	8	7	8	8
Extraneous variables	3	4	4	5	3	6	3	6	3	4	6	6	4	6	4	6	3	6	6
Internal validity	4	4	6	6	2	5	6	6	4	4	6	6	6	6	4	4	5	6	6
Sample representativity	5	3	6	4	7	8	5	8	6	8	8	8	6	7	5	8	6	8	8
External validity	5	8	5	8	3	7	6	7	5	7	9	9	5	8	5	8	7	7	7
Sub-group analysis	0	2	2	5	2	4	2	5	2	2	5	5	2	4	2	5	2	4	4
Other evaluations	12	11	9	16	14	14	9	16	11	14	14	14	10	15	9	15	10	13	13
Total	53	66	66	90	66	87	66	85	58	77	96	96	63	88	66	96	68	81	81
%	54	67	67	91	67	88	67	86	59	78	97	97	64	89	67	97	69	82	82

CREST = Critical Research Evaluation Schedule for Trainees; R1 = rater 1; R2 = rater 2.

Although low agreement was attained on exact CREST scores, a consensus was achieved concerning the overall quality of evidence of an adequate standard and regarding general trends in methodological, statistical, and discursive weakness. Power calculations were not reported in four of nine studies,^{43,45-47} and they were thus ranked as unacceptable. Sample sizes were rated as unacceptable for two of nine studies, according to one author's (JR's) power calculations.^{43,47} These two studies made no clear attempt to control for gender, race, or medical or psychiatric history between groups at baseline. No study conducted a sub-group analysis of any type and, although the majority of them were rated as acceptable, three were unanimously ranked as unacceptable because there was no attempted analysis of age differences,^{43,47,53} and two of these were also ranked as unacceptable for other differences (e.g., environment, education).^{43,47} Although all studies used validated outcome measures, a general reliance on unvalidated and subjective sleep diary data reduced the reliability of most studies.^{43-45,47,49,51} Moreover, only three studies used objective measures of sleep,^{44,47,51} specifically actigraphy, to analyze changes in symptoms of insomnia.

The evidence base was of an adequate quality; however, failure to report power calculations and a reliance on inadequate sample sizes and subjective sleep diary data impaired the reliability and validity of trial results. A lack of control or consideration for extraneous variables, such as age or psychiatric, medical, or occupational history, further calls into question the scientific integrity of the evidence base. Despite these concerns, the use of an RCT design in primary care Veteran-specific services set a good standard for the ecological validity of the nine studies.

DISCUSSION

This evaluation of the scientific quality of the evidence base addressed the two objectives of this review of the effectiveness of CBT-I among the Veteran population. The nine studies were deemed to be of a generally adequate, but inconsistent, quality, the results of which lacked the homogeneity to state with confidence that CBT-I is effective in addressing all symptoms of insomnia among the Veteran population. The first objective of this review was to evaluate whether the evidence can demonstrate the effectiveness of individual components of CBT-I. For a trial to assess such effectiveness would require a comparative analysis, for example, between stages of varying combinations of psychoedu-

cation, stimulus control, sleep restriction, and cognitive restructuring. No trial conducted such an analysis; thus, the evidence did not demonstrate the effectiveness of separate interventions.

Most studies used all four key components of CBT-I (psychoeducation, stimulus control, sleep restriction, and cognitive therapy techniques). Anecdotally, it is worth noting that trials that reported a consistently good effect on all insomnia measures used a full CBT-I approach. The difference in methodology and number of trials that used a behavioural or full CBT-I approach, however, does not allow the drawing of any objective conclusions regarding the effectiveness of cognitive therapy techniques. Given the methodology of the trials reviewed, the evidence contributes very little to an understanding of individual components of CBT-I, which may be a focus for future research.

Given the prevalence of traumatic and functional predisposing, precipitating, and perpetuating factors causing insomnia among the Veteran population,¹⁷ the second objective of this review was to examine the degree to which studies considered, targeted, and measured such factors. By design, CBT-I should address functional causes of insomnia through the correction of sleep-related behaviour and dysfunctional beliefs. Therefore, to correctly address purely functional causes of insomnia, one would expect to see a change in subjective and objective measures of sleep performance, related behaviours, and beliefs. The impact of CBT-I on these measures was inconsistent across all studies. The evaluation of whether such inconsistency is purely the result of differences in intervention intensity is beyond the scope and methodological capacity of this review. Instead, the authors question whether inconsistency in findings could be the result of a complex interaction between functional causation and the impact of trauma on insomnia specific to the Veteran experience.¹⁷ Generally, the studies in this review considered and measured perpetuating traumatic causes of insomnia, such as nightmares and hyperarousal; however, they did not explicitly report any trauma-specific adaptation to components of CBT-I. Moreover, the evidence did not demonstrate a consistent effect of CBT-I on traumatic perpetuating causes of insomnia, but the introduction of specialized interventions, such as IRT and prolonged exposure, did.

Whereas the prevalence of insomnia among the U.S. Veteran population is recorded and treated with specific clinical guidance, this is not the case in the United Kingdom.^{2,10,38} In Canada, no guidelines are

provided for the treatment of insomnia among Veterans. In all three countries, however, CBT-I is delivered to Veterans through primary care services.^{3,4,38} On the basis of the findings of this review, it can be argued that a lack of consistent results and scientific rigour create cause for concern regarding the clinical recommendations and practice of CBT-I as a first-line treatment for insomnia among Veterans. In addition, an analysis is needed of the existing prevalence and treatment of insomnia among Veterans who present to Canadian and British primary care services.

No trial compared the effectiveness of individual components of CBT-I, and the authors are unable to objectively compare trials of differing time and content intensity (e.g., brief vs. full CBT-I). Therefore, this review cannot support stepped delivery of CBT-I in an effort to increase service cost-effectiveness. CBT-I was not found to address predisposing, precipitating, or perpetuating traumatic causes of insomnia among the Veteran population, which are arguably the primary treatment targets of an intervention, along with functional factors. It may be that residual, trauma-related causes of insomnia impair the effectiveness of CBT-I to regulate healthy sleep cycles, beliefs, and behaviours. The findings of this review support the conclusion of Phelps and colleagues that CBT-I is best supported in conjunction with a PTSD-specific psychological treatment,⁴¹ such as IRT or prolonged exposure.^{42,53}

The inconsistent effectiveness of CBT-I demonstrated in the evidence base reviewed may be the product of a rigid reliance on targeting a psychiatric construct over an empirically supported psychological formulation of insomnia presentations among Veterans. Such oversight questions the appropriateness of clinical recommendations for a treatment that seemingly solves only half the problem. The current review provides a basis for a wider discussion as to whether the process of developing clinical guidelines for the treatment of a mental health problem does, or should, consider an empirically supported psychological formulation of the presentation.

Limitations

This review was limited by the evaluation tool used and the exclusion criteria applied. The CREST provides an extensive capacity to evaluate the statistical, internal, and external validity and reliability of research, but it is not a validated tool (“Guidelines for Completing the ‘Clinical Research Evaluation Sheet for Trainees’ (CREST),” unpublished manuscript by Peck, Dow, and

Goodall). Its weak inter-rater reliability in this review demonstrates the tool’s relative subjectiveness. In an effort to obtain strong inter-rater reliability, both raters were trained in the use of the CREST, and both demonstrated similar pre-existing knowledge of the research area. The greatest disagreements between the two raters occurred in the categories of external validity and other evaluations. It could be argued that one would expect the greatest disagreement in these two categories, as compared with other categories that focus on design and analysis, because they require the raters to make greater use of their own judgement regarding the study’s implications and its author’s interpretation of the data relative to the existing literature.

The review was not wholly representative of a full Veteran population because it intentionally excluded trials not translated into English or that explicitly included older participants or those with physical health, neurological, or substance misuse problems. The authors are limited to commenting purely on a psychological model and treatment of a disorder reportedly precipitated and perpetuated by chronic health conditions and physical sleep disorders.^{8,54,55} Thus, this review may not be applicable to cases of sleep disturbed by physical factors, such as sleep apnoea or chronic pain.

To address residual symptoms of insomnia, further evaluations of conceptualization and treatment should consider, in more detail, the biological factors that contribute to disturbed sleep.^{8,54,56} Finally, the exclusion criteria applied restrict the review’s ability to comment on the effectiveness of the delivery of CBT-I via alternative, less expensive formats, such as group or digital.

Conclusion

Although all the studies reviewed demonstrated some effect of CBT-I on symptoms of insomnia, it can be argued the evidence lacks the consistency and quality necessary to confidently support clinical recommendations for the use of CBT-I with the Veteran population.^{3,4,38} The lack of a component analysis precludes making any recommendations about the implementation of abbreviated or stepped alterations to the intervention. Moreover, it is likely that the inability of CBT-I to address traumatic causes of disturbed sleep hinders its capacity to treat insomnia presentations among Veterans.

Future research trials would benefit from considering the recommendations of this review. Continued evaluation of the cost-effectiveness of interventions aimed at addressing the complex causes of insomnia

among the Veteran population could enhance the confidence or suitability of U.S. clinical recommendations.^{17,38} Similarly, this review identified an opportunity for British and Canadian researchers to consider the treatment of insomnia for their Veteran populations. Finally, this review questions whether clinical guidelines for the treatment of a mental health presentation do, or should, consider empirically supported psychological formulations.

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The authors have nothing to disclose.

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